

about thirty miles north of Quincy. The river was nearly stationary during the first few days of the month, but after the 6th it rose steadily and on the 11th had overflowed to such an extent that at this place it was ten miles wide, and hundreds of farms were submerged, the water being several feet deep. The Saint Louis, Keokuk, and Northwestern Railroad discontinued the running of trains north of Quincy, cutting off communication between La Grange, Canton, and Alexandria, Mo. On the 13th the river was within two feet of the highest point attained during the year 1881 and continued to rise. On this date sixty-five miles of railroad track between Hannibal, Mo., and Keokuk, Iowa, were submerged to a depth ranging from six inches to three feet. Within the limits of Quincy the high water caused much inconvenience to foundries and factories, and at the water-works. The breaks in the Indian Grave levee during the night of the 13-14th caused a further rise and consequently an increase in the overflowed area. On the 17th the water reached a height exceeding that of the flood of 1881, leaving only the flood of 1851 with a higher record. On this date the factories in the manufacturing districts were nearly all shut down, and there was more than three feet of water in the water-works. The Sny levee broke in several places immediately above the Hannibal bridge at 6.15 a. m., flooding a thickly populated district, and compelling the inhabitants to move.

Concerning the flood in the vicinity of Quincy, the "Chicago Times" of the 18th contained the following:

Above and below Quincy are over one hundred miles of levees, protecting fully 200,000 acres of the most productive farming lands in the valley. On Sunday morning, 13th, the first break occurred in the great embankment known as the Indian Grave levee. During the day two other crevasses were made, and within a few hours thousands of acres of winter wheat that promised a yield of from forty to sixty bushels to the acre were laid waste. The farmers had been working on the embankment night and day in the hope of saving their homes, and when the flood came a majority of them had barely time to save their families, so sudden and overwhelming was the rush of the torrents.

Outside the embankment was the great river, a solid body of water twenty feet deep, and as soon as a crevasse was made it poured through the opening with a roar that could be heard a long distance. Homes were deserted on a moment's notice from riders who were sent out to give warning of the dangers, in many cases the people being obliged to leave everything and to fly to the bluffs or seek safety in boats. On Monday the Sny Carte levee, an embankment commencing just below Quincy and extending south a distance of fifty-four miles, gave way between Hannibal and Louisiana, and the scenes enacted the day previous were repeated and intensified.

Early in the week the Alexandria levee, thirty miles above Quincy, gave way, completely flooding that thrifty city. The crevasses made in the Sny levee at East Hannibal to-day completed the destruction in all the levee districts. Not an acre of ground in this vast territory can escape the flood, and the loss to farming interests is simply incalculable. Cattle and horses in the fine wooded pastures were overwhelmed in many localities and drowned. The river above and below the city is from ten to fifteen miles broad, covering all the farms on both sides and extending from the bluffs on the Illinois side to the high bluffs in Missouri.

On the dry places on the embankment are hundred of cattle, horses, and hogs without feed and no prospect of drink, except when in danger of being swallowed up by the floods. Far across on the opposite bluffs are gathered hundreds of men, women, and children, many of them utterly destitute, having neither sufficient clothing nor shelter, and some suffering for food, despite the bravery of their more fortunate neighbors, who are making every exertion to relieve their immediate wants.

The "Saint Louis Post-Despatch" of the 19th says:

QUINCY, Ill., May 19.—The river is falling very slowly at this point. Since 2 p. m. Thursday, 17th, when the highest point, 19 feet 9½ inches, was reached, it has fallen four inches. The extent and position of the levees that have given way during the present tremendous rise are as follows: The Hunt levee is in Hancock Co., extending from Warsaw to four and one-half miles above Canton, Mo. It was built in 1879. It is twelve miles long and cost from \$50,000 to \$60,000. This levee enclosed from 16,000 to 17,000 acres of land, largely cultivated and covered with growing crops. At least one hundred families lived in this district, and they are now homeless and destitute.

The Indian Grave levee is eighteen miles long, twelve miles on the river

and six in the two cross levees, one of which is opposite Canton, and the other at the head of the bay, and is entirely within Adams Co. This levee was built in 1879, at a cost of about \$200,000. It inclosed a fertile district of 14,000 or 16,000 acres, land generally improved and planted with growing crops. The amount actually lost in these two districts can only be roughly estimated.

The following reports relate to freshets which occurred in other sections of the country:

Chippewa Falls, Chippewa Co., Wis.: a part of this town was inundated on the 1st compelling several families to move.

Brownsville, Tex.: the Rio Grande river was very high on the 1st and 2d, and overflowed on the latter date in two places between Santa Maria, Tex., and this city. The river began to fall slowly on the 3d.

Fort Benton, Mont.: the Missouri River reached an unusually high stage on the 12th, compelling suspension of work on the bridge now being constructed.

Ishpeming, Marquette, Co., Mich.: about one mile of the Duluth, South Shore, and Atlantic railroad track near here was three feet under water on the 12th.

Marinette, Marinette, Co., Wis.: the Menominee River reached on the 12th the highest stage known for many years.

Galena, Jo Daviess Co., Ill.: on the 12th a large part of this place was inundated to such an extent that boats were used in several streets. The water reached a depth permitting boats to be rowed about the Custom House and Post Office buildings.

Livermore Falls, Androscoggin Co., Me.: some roads in this vicinity were from three to five feet under water on the 12th.

Shakopee, Scott Co., Minn., 12th: the rains of the past week have been unusually heavy, and have caused the Minnesota River to overflow adjacent bottom lands.

The "Kansas City Journal" of May 14th, says:

St. Louis, May 13.—Advises from in the Red River country report that the damage done the Red River Valley during the past ten days is almost beyond computation, and the overflow the largest since 1848. Most of the plantations near the river have been covered with water four to six feet deep, and many miles of fencing, cribs, and barns have been washed down and carried away. Many of the people have lost their household furniture, provisions, and corn. In several places the water extended from the hills of Arkansas to the hills of Texas, a distance of ten to fourteen miles.

New Haven, Conn.: reports from Hartford on the 15th stated that a rise of two and one-half feet had occurred in the Connecticut River since the day previous, and that some of the docks were submerged.

Fort Fairfield, Aroostook Co., Me., 16th: numerous washouts have occurred on the New Brunswick Railroad. A large quantity of lumber was washed away at this place on the 15th.

Lead Hill, Boone Co., Ark., 17th: all streams running into White River in this locality overflowed, causing damage to fences and crops. White River was very high on the above date, overflowed bottom-lands, but did no serious damage.

Hannibal, Mo: the lower part of this place was submerged on the 17th; business was practically suspended in consequence.

Eau Claire, Eau Claire Co., Wis.: more than one hundred families were compelled to vacate their homes on account of the flood on the 18th.

Stockton, Rooks Co., Kans., 26th: the heavy rain during the night of the 25-26th caused the Solomon River to flood the adjacent lowlands.

Atchison, Kans.: streams in this section were greatly swollen by the heavy rains of the 26th, and many washouts occurred.

Tilden, Madison Co., Nebr., 27th: the recent heavy rains have swollen the Elkhorn River and caused washouts in the surrounding country.

#### HIGH TIDES.

Southport, N. C., 21st, 24th, 30th; Cedar Keys, Fla., 25th; Wilmington, N. C., 28th, 29th.

### ATMOSPHERIC ELECTRICITY.

#### THUNDER-STORMS.

From the accompanying table it will be seen that thunder-

storms were reported from the largest number (thirty-three) of states or territories on the 28th, and that they occurred in

nearly as many (twenty-eight) on the 29th and 30th. They were least extensively reported on the 13th, on which date they occurred in but ten states or territories, the 2d and 16th being nearly as free from thunder-storms as the 13th. In Florida, Indian Territory, Kansas, and Texas thunder-storms occurred on from twenty-six to twenty-nine days out of the month, Texas reporting the greatest number of dates. They occurred on five days, or less, in Connecticut, the District of Columbia, Maine, New Hampshire, Rhode Island, Utah, Vermont, and Washington Territory; Maine and Utah showing the least, one. There was no state or territory in which they did not occur.

Table showing the number of stations in the several states and territories reporting thunder-storms for each day during May, 1888.

State or Territory.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.	31.
Ala.			4	4				4	3	2	1		1	1					1		2	1					1	2	2	2	
Ariz.				3	3										1																
Ark.				3				2		2	2			2	1	3	3	1	1												
Cal.													6	9	1	1															
Colo.					1	3		1									2	1	1	1	5	4	3	2	1	2				2	3
Conn.																															
Dak.		1	2																	4	2	2							2	4	1
D. C.																															
Fla.																															
Ga.		1		2	3	5			1	1		4	7	8	1	1		2	1	5	11	7	7	1	3	5	4	2	5	7	4
Gu.				2	2	3	1	2	4	4	7	8	1	1	1																
Ill.				1	7	2		3	3	3	1	3	2										1	2	4			2	5	7	4
Ind.				3	3		1	5	4	1		3											1	2	4			2	5	7	4
Ind. T.			1	1	3	3	1	5	4	1	2	3	1										3	3	3	1	1	3	4	1	1
Iowa		2	13	22			3	4				14											4	3	3	1	1	14	8	8	1
Kans.		1	7	9	1	5	11	5	1	2	8	3		1	10	1	8					4	7	14	1	1	9	5	3	3	1
Ky.																															
La.																															
Me.																															
Md.																															
Mass.																															
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Ohio.																															
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R. I.																															
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Tenn.																															
Tex.																															
Utah																															

The Signal Service observer at Eureka, Humboldt Co., Cal., reports:

Between 10 a. m. and noon on the 22d distant thunder was heard at intervals and a light shower of rain fell. This thunder-storm was of moderate character and in the Eastern States would have attracted no attention, but as thunder-storms are of rare occurrence here it was a matter of great surprise.

#### AURORAS.

Auroral displays were quite extensively observed on the evenings of the 7th and 20th. On the 7th a cloud-area extended from Colorado and Wyoming eastward to the lower lakes and Ohio Valley, doubtless obscuring the aurora at many of the more northerly stations at which it prevailed. This display was quite brilliant over the northern portions of Minnesota and Dakota and the upper lake region, and at some stations in New England.

The evening of the 20th was quite favorable for observing the aurora which occurred on that date. An area of cloudiness, however, covered the extreme northern portions of the upper lake region and upper Mississippi valley, but the weather was generally clear in other northern districts east of the Rocky Mountains, and the aurora was reported from a majority of the reporting stations in the northern districts from the Mississippi Valley eastward to the New England coast.

While the display of the 20th was not reported to the westward of Minnesota it was seen in more southerly latitudes than was the more extended display of the 7th.

The following are descriptions of the more important displays of the month:

Hartford, Conn.: a very brilliant aurora was visible on the 6th, consisting of a long band stretching nearly to the zenith, and a number of short streamers.

Bismarck, Dak.: an aurora was observed at 11.30 p. m., 7th, consisting of an arch of yellow light which extended to altitude 45° and covered the horizon from azimuth 135° to 225°. At 11.30 p. m. some streamers were noticed, and at the same time a pillar of light, separate from the main aurora, appeared in azimuth 120°, with radiating streamers at the top which rose to altitude 90°; the aurora ended at 2 a. m.

Fort Buford, Dak.: on the evening of the 7th a brilliant aurora was observed in the form of a whitish light resting on a dark base, from which streamers of orange color tinted with green rose to an altitude of 75°. The display was most brilliant from 11.58 p. m. to 12.25 a. m.

Moorhead, Minn.: a well-defined auroral arch of altitude 25° was observed at 10.50 p. m., 7th. The arch rose gradually until near midnight when it extended across the zenith in the form of a broad, sharply defined belt of light. Just before the arch began to rise the whole northern sky was covered for about twenty minutes with streamers shooting up to an altitude of 80°.

The following is furnished by Harvard College Observatory, Cambridge, Mass.:

Aurora looked for every clear evening; results as follows: May 7th, 11.15 p. m., low auroral arch; first seen at 9 p. m.; still visible. 20th, irregular aurora, bright in moonlight, with some appearance of streamers, conspicuous about 9.30 p. m. and later; sky not especially dark below. About 1.45 a. m., 21st, straight the aurora had the form of a pair of distinct arches, side by side, with a band connecting them in the north; sky dark below. About 2.30, aurora, irregular, with faint light as high as Polaris.

Marquette, Mich.: a very brilliant aurora was observed from 8.10 to 11.40 p. m., 7th; it first appeared as a pale white arch, extending from azimuth 135° to 230°; at 9.50 p. m. a number of bright streamers of various heights, a few reaching an altitude of 70°, were observed; sheets of light of pink, green, and yellow colors, having a lateral, as well as an upward and downward, motion, were also observed.

The Rapid City, Dak., "Daily Journal" of the 8th states that a remarkably fine display of the aurora was seen at that place during the early morning of the 7th.

Saint Vincent, Minn.: an aurora was observed at 10.30 p. m., 8th, at which time it appeared as an indistinct pillar of light in the north, having an altitude of 35° and a slow motion to the westward; at 11 p. m. it had reached a position at right angles to the magnetic meridian, and there appeared a fine arch of light, extending from the eastern to the western horizon, passing through the zenith; short columns of light converged towards the zenith; the arch began to fade at 11.30 p. m., the ends bending in toward the north and the crowns moving slowly southward, and disappeared when 10° south of the zenith; a faint whitish light shone in the north during the remainder of the night. On the 20th an irregular auroral arch, 35° high, was observed at 10 p. m.; at 10.30 p. m. the arch had reached an altitude of 55°, and the space between it and the zenith was covered with confused masses of white light resembling cirrus-stratus clouds; the maximum intensity of the display occurred at 10.50 p. m., when almost the entire heavens were covered with patches of auroral clouds, converging at, or near, the zenith; the general movement of the light was easterly and southerly.

New Haven, Conn.: an aurora became visible at 8.30 p. m. on the 20th; it first consisted of an arch, resting on a dark segment, which extended to altitude 30° and covered 80° of the horizon; the aurora was quite brilliant at times and faded away gradually until at 9.30 p. m., when the arch changed to streamers, and at 10.30 p. m. the northern sky was all aglow

with merry dancers, extending up to altitude 80°; its maximum brilliancy occurred at 11 p. m., and the display ended at midnight.

Burlington, Vt.: a very brilliant aurora was observed from 9 p. m. to midnight of the 20th; waving flashes of light extended from altitude 10° to the zenith.

Lansing, Mich.: an aurora was observed from 9.10 to 11 p. m. on the 20th, consisting of two arches, the lower one having an altitude of 25°. Streamers shot up at intervals from the lower arch to an altitude of 40°.

Clinton, Clinton Co.: an auroral arch extended from east to west and to an altitude of 40° from 9 to 10 p. m. on the 20th.

Manchester, N. H.: an aurora was observed at 9.30 p. m., 20th, as a narrow, irregular arch above a dark segment; the arch extended to altitude 30° and covered 100° of the horizon; the aurora increased slightly in brilliancy after 10.15 p. m., when faint merry dancers appeared along the upper edge of the arch, shooting upwards to the zenith.

Mr. A. G. Wolf, the light-house keeper at Atlantic City, N. J., reports having observed an auroral arch, resting on a dark segment 10° high, from 10.30 p. m. on the 21st until 3 a. m. on the following date; the arch extended to altitude 45° and covered about 79° of the horizon.

Auroras were observed on the several dates during the month as follows; 1st, Oakland, Cal.; Traverse City, Mich.; Fort Assinaboine and Poplar River, Mont. 2d, Clayton, Egg Harbor City, Moorestown, N. J.; Quakertown, Pa.; Burlington, Vt. 3d, Kalamazoo, Mich. 4th, Parkston, Dak. 5th, Quakertown, Pa. 6th, Hartford, Conn.; Saint Vincent, Minn.; Fort Custer,

Fort Maginnis, and Poplar River, Mont. 7th, Voluntown, Conn.; Bismarck, Fort Buford, Fort Yates, Leach Farm, and Webster, Dak.; Eastport and Orono, Me.; Blue Hill Observatory, Cambridge, and Provincetown, Mass.; Alpena and Marquette, Mich.; Moorhead and Saint Vincent, Minn.; Fort Custer, Fort Maginnis, and Poplar River, Mont.; Nashau, N. H.; Oswego, N. Y.; Burlington and Northfield, Vt. 8th, Rapid City, Dak.; Eastport and Orono, Me.; Saint Vincent, Minn.; Poplar River, Mont. 9th, Smithland, Iowa; Eastport, Gardiner, and Orono, Me.; Saint Vincent, Minn.; Poplar River, Mont. 10th, Parkston, Dak. 12th, Saint Vincent, Minn. 15th, Saint Vincent, Minn. 18th, Parkston, Dak.; Nashau, N. H. 20th, New Haven, Conn.; Leech Farm, Dak.; Amana, Clinton, Cresco, Dubuque, Maquoketa, Monticello, and Osage, Iowa; Eastport, Gardiner, and Portland, Me.; Blue Hill Observatory, Boston, Cambridge, and Provincetown, Mass.; Grand Haven, Lansing, and Thornville, Mich.; Saint Vincent, Minn.; and Poplar River, Mont.; Manchester and Nashua, N. H.; Moorestown, N. J.; Buffalo, Ithaca, Lyons, Oswego, Rose, and Senauket, N. Y.; Elyria, Bellevue, Garrettsville, Sandusky, Tiffin, Toledo, Wauseon, and Yellow Springs, Ohio; Erie, Catawissa, State College, and Wellsborough, Pa.; Burlington, Vt.; Beloit, Delavan, Deuster, and La Crosse, Wis. 21st, Kent's Hill, Me.; Poplar River, Mont.; Albany and Ardenia, N. Y.; Dyberry and Erie, Pa. 22d, Atlantic City, N. J.; Detroit, Mich. 27th, Fort Maginnis, Mont. 28th, Parkston, Dak.; Traverse City, Mich. 29th, Parkston, Dak.; Lyons, N. Y.; Milwaukee, Wis. 30th, Windsor, Ill. 31st Saint Vincent, Minn.

### MISCELLANEOUS PHENOMENA.

#### DROUGHT.

Limona, Hillsborough Co., Fla., 3d: vegetation is suffering greatly for rain.

Savannah, Ga., 4th: no rain has fallen since April 23d, when a slight thunder shower occurred, and vegetation is suffering. Previous to the rains of the 9th drought prevailed in this section, causing injury to vegetation in general.

University, Miss.: the rains of the 4th and 5th were of great benefit to crops, which had been suffering seriously from drought.

Augusta, Ga., 7th: on account of the prevailing drought the oat crop has been seriously injured; cotton and truck farming interests have also sustained some injury. Rain fell on the 8th, and though very light, it was of great benefit.

The voluntary observer at Prospect, Bermuda Island, reports that the total precipitation for May, 0.63 inch, was the least recorded in that month during the last nine years; the next smallest amount in May, being 2.37 inches.

#### FOREST AND PRAIRIE FIRES.

Chatham, Barnstable Co., Mass., 9th: a forest fire destroyed much valuable woodland in the vicinity of South Brewster, in this county.

Prairie fires are reported to have occurred at Moorhead, Minn., on the 1st, 4th, 8th, 15th, 18th, and at Saint Vincent, Minn., on the 10th.

#### HALOS.

The dates on which solar halos were observed over the greatest extent of territory during May were the 6th, 17th, 21st, and 23d; they were least numerous on the 7th, and from the 13th to 15th. They were observed on from ten to fourteen dates in Dakota, Kansas, New York, Tennessee, and Washington Territory; Dakota reporting the maximum. None were reported from Arkansas, Florida, Louisiana, Missouri, New Mexico, and Rhode Island.

Between the 1st, and 16th, and from the 26th to 31st, very few lunar halos were reported, there being eight days of the first named interval on which none were recorded; from the

17th until 25th, inclusive, they were quite numerous, being observed in twenty-two states or territories on the 21st. They were seen on from six to eleven days during the month in Arizona, California, Iowa, Kansas, Pennsylvania, Texas (maximum), and Virginia. None were reported from Georgia, Idaho, Indian Territory, Maine, Michigan, New Mexico, Rhode Island, Utah, Washington Territory, and Wyoming.

The Chief Signal Officer has received through the Honorable Secretaries of State and War an interesting photograph of a solar corona which was observed at San José, Costa Rica, May 1, 1888, concerning which the United States consul at Costa Rica, who forwarded the photograph to the State Department, reports as follows: "The circle was apparent from 10 a. m. to 1 p. m., and three colors of the rainbow, red, blue, and yellow, showed in the white circle, although not represented in the photograph."

The phases of the moon, Washington mean time, during May, as given in "The American Ephemeris and Nautical Almanac," are as follows: last quarter, 2d, 6h. 38.9m.; new moon, 10th, 8h. 15.3m.; first quarter, 18th, 5h. 57m.; full moon, 24th, 20h. 31.9m.; last quarter, 31st, 19h. 45.1m.; apogee, 9th, 8.1 h.; perigee, 24th, 1.6 h.

#### METEORS.

Keeler, Cal.: a meteor of extraordinary size and brilliancy was observed on the evening of the 12th at 10.15 p. m. It was first seen in altitude 23° and azimuth 90°, and remained visible for fifteen seconds. It moved in a horizontal line to azimuth 40° where it disappeared behind the Sierra Nevada mountains. The size and brilliancy of the meteor were equal to the full moon, and it left a fan-shaped trail fully 20° in length, which remained visible until the disappearance of the meteor.

Meteors were also observed as follows: 1st, Fort Stanton, N. Mex.; Wauseon, Ohio. 2d, Quakertown, Pa. 3d, Cedar Keys, Fla. 4th, Lead Hill, Ark. 5th, Ithaca, N. Y. 6th, Cairo, Ill.; McMinnville, Oregon. 7th, Cleburne, Tex. 8th, Wilmington, N. C. 11th, Cedar Keys, Fla. 12th, Clear Lake,